OUTLINE SHEET 4-2-1
Fasteners

A. Introduction

The use of improper fasteners have resulted in numerous injuries, deaths, and even loss of ships. Being able to identify the proper fastener to use is a highly valued skill found in a successful engineer.

B. Enabling Objectives

4.6 **DESCRIBE** the procedures used to identify fasteners.

4.5 **DESCRIBE** the procedures for replacing fasteners.

C. Topic Outline

1. Introduction
2. Movie - Fastener Selection and Installation
3. Threaded Fasteners
4. Markings
5. Fastener Selection
6. Summary and Review
7. Assignment

ASSIGNMENT SHEET 4-2-2
Fasteners

A. Introduction

This material is to be completed prior to the material being covered in class.

B. Enabling Objectives

Refer to enabling objectives in Outline Sheet 4-2-1.

C. Study Assignment

1. Read Information Sheet 4-2-3

D. Study Questions

1. How does locknuts prevent loosening of fasteners?
2. What is the ideal number thread(s) protruding from the top of a nut?
3. Why are brass fasteners unsuitable for steam lines?
4. Why are steel fasteners unsuitable for seawater lines?

INFORMATION SHEET 4-2-3
Fasteners

A. Introduction

This information describes fasteners.

B. Reference

NSTM Chapter 075 THREADED FASTENERS
NSTM Chapter 505 PIPING SYSTEMS
Fireman NAVEDTRA 12001

C. Information

I. Fasteners are used to attach or join parts together.
- A. A bolt is a fastener with a head on one end and the body or shank fully or partly threaded.
- B. A stud is a fastener threaded on both ends, or its shank may be completely threaded from end to end.
- C. Nuts have internal threads that match the threads of a stud or bolt.
  1. Locknuts are used to ensure that the fasteners will not loosen.
  2. Threads on the lock nut distort to lock the fastener in place.
  3. Jam nuts are installed with the thinner nut to the working surface. The thin nut is deformed by the wider nut and pressed against the working surface and threads.
- D. Washers are placed under a nut or bolt to relieve friction, prevent leakage, and distribute pressure.
  1. Lockwashers are used to prevent threaded fasteners from loosening.
- E. Bolts and studs must have at least one complete thread beyond the top of the nut.
  1. Excessive length is a hazard to personnel. The excess threads may also become exposed to corrosion and damage making the fastener difficult to remove.
  2. Where possible, the number of threads should not exceed 5. In no case should thread protrusion exceed 10 threads.
- F. Safety wiring is used to prevent the nut, bolt, screw, or any other threaded part from backing off.
  1. This can be done by installing the wire in such a way that it will tighten by pulling against the wire as it loosens.
  2. Lock wiring diagrams may be used to show procedures for a given situation.

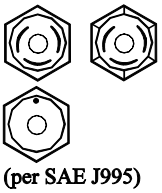
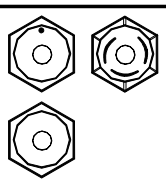
G. Cotter pins are used to prevent a castellated nut from turning. They are inserted through a pre-drilled hole on the stud or bolt that aligns with the slots on the castellated nut. The ends may be spread apart over the stud or flat against the nut.

II. Threaded fasteners are identified by grade and material.
   A. Grade and material are indicated by permanent markings on the fastener.
   B. Grade marking indicates the strength of a steel bolt. The grade is identified by the number of slashes on the head of the bolt.
      1. The more slashes the higher the strength of the bolt.
         a) 2 lines indicate grade 3
         b) 3 lines indicate grade 5
         c) 4 lines indicate grade 6
         d) 5 lines indicate grade 7
         e) 6 lines indicate grade 8
   C. NSTM Chapter 075 has a table with the markings referenced against the material and grade.
   D. Correct material identification is extremely important when using fasteners.
      1. High temperature, high pressure steam applications use high carbon steel
      2. Flanges in a seawater piping system will use brass fasteners.
      3. If brass is used in steam line or steel in seawater lines the results could be fatal.
      4. The magnetic properties of fasteners may be used, with other Quality Assurance methods to determine whether the correct fastener is installed. Brass fasteners are not magnetic while steel fasteners are.
   E. Grade and material identification on nuts are similar to that of bolts and studs. The grade and material of a nut should be identical to that of the matching bolt.

III. When selecting replacement fasteners, do not rely on markings of the existing fastener. The wrong fastener may have been installed in the past.
   A. Review technical documentation such as parts list to order replacements
   B. Some fasteners may come in a box with a part number. This part number may be used to identify the material, diameter, thread design, length, and other special features. Refer to the NSTM Chapter 075 to interpret the codes contained in the part number.
   C. Often, fasteners of different grades and materials but of the same color, size and shape are in the same container. Always ensure the correct replacement fastener is used. If in doubt about a fastener, ask your supervisor.

DIAGRAM SHEET 4-2-4
Fastener Identification

TABLE 075-1 FASTENER IDENTIFICATION MARKINGS

Material Type	Material Grade	Fastener Type	Chemical Requirement (Government or Industry Standard)	Identification Marking
Carbon and Alloy Steels	2	Stud, bolt, hex cap screw	SAE J429 ASTM A307 ASTM A394	None
	5	Stud, bolt, hex cap screw	SAE J429 & ASTM A449 TY 1	
			ASTM A364 GR BC	
			ASTM A325	
	8	Stud, bolt, hex cap screw	SAE J429 & ASTM A354 GR BD	 (NOTE: Bolts to A354 may also add "BD"
			ASTM 490	
	2	Nut	SAE J995	None
	5	Nut	SAE J995	 (per MIL-S-1222)
			SAE J995 GR 5	 (per SAE J995)
			ASTM A563 GR C	
	8	Nut	SAE J995	 (per MIL-S-1222)
			SAE J 995	 (per SAE J995)